PATENT SPECIFICATION

Application Date: Sept. 20, 1918. No. 15,301/18. **188,676**

Accepted: April 12th, 1919 (but withheld from Publication under Section 30 of the Patents and Designs Acts, 1907 and 1919).

Authorised to be Published: Oct. 4, 1922. Date of Publication: Dec. 14, 1922.

COMPLETE SPECIFICATION.

Improvements relating to the Detection of the Presence of Submarine Vessels and other Conducting Bodies.

I, ALEXANDER GEORGE IONIDES, Captain, R.A.F., of 278, East Park Road, Leicester, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the detection of conducting bodies submerged in an electrolyte and is more particularly intended for use in the detection of submarines whether stationary or under way but it may also be employed for the detection of other bodies or masses of metal.

It has been found that conducting bodies of a certain type as for example submarines whether stationary or under way send out or can be caused to send out into the sea a current which may be detected by suitable means. According to this invention two or more electrodes are spaced apart in the electrolyte and disposed in circuit with a galvanometer or like instrument adapted to indicate the presence of a continuous or direct current which flows or is caused to flow from the submerged conducting body. A charging current may be employed to set up a secondary current from the conducting body which is then detected in the manner described. For this purpose two electrodes are suitably disposed in the electrolyte through which a current from some convenient source is caused to flow. In either case whether a charging current is used or not the detection may be effected by one or more galvanometers with or without a resistance or a differential galvanometer may be employed.

The apparatus may be arranged in various ways in accordance with requirements and as it may be found necessary or not to employ a charging current. The accompanying drawings illustrate diagrammatically and by way of example alternative arrangements of the apparatus which may be used. In these drawings:—

Figure 1 shows a simple arrangement suitable for use when no charging current is used.

Figure 2 is a similar view showing a simple arrangement when a charging current is employed.

Figure 3 illustrates an arrangement of the apparatus for use without a charging current and when it is desired to obtain some indication of direction or position of the conducting body which is to be detected.

Referring to Figure 1 two electrodes A and B of suitable construction are towed by cables from a vessel C. The electrodes are spaced apart as shown so that the electrode A is positioned an appreciable distance from the electrode B while the electrode A is also towed at an appreciable distance from the stern of the vessel C. On the latter is a galvanometer D which is connected to the cables from the electrodes A and B. If the vessel tows the electrodes over or adjacent to a submerged conducting body such as a submarine the presence of this body will be detected owing to the direct current given out by it causing a deflection of the galvanometer.

If the conducting body is of a type which will not send out a direct current which can be detected in this manner or if it is desired to intensify this current apparatus such as shown in Figure 2 may be used. In this case in addition to the detecting electrodes A and B and the galvanometer D in circuit, therewith there are towed from the ship C two other electrodes E and F which are connected by cables with a suitable motor G or other source of continuous or direct

[Price 1/-]

current. The charging electrodes E and E are positioned in the water so that the electrode F lies some distance astern of the aftermost detecting electrode B while the other charging electrode E is towed a short distance ahead of the foremost detecting electrode A. A current can now be sent through the electrolyte by means of the electrodes E and F in such a way that the submerged conducting body becomes charged as a secondary battery. The secondary current which then flows from the conducting body when the charging current is stopped can be detected by the electrodes A and B and the galvanometer D. The charging current is interrupted at suitable intervals of time and the detecting circuit is closed so that any small difference of potential will be indicated.

The electrodes employed at A and B for detecting purposes should be constructed so as to be non-polarisable or little polarisable. When the electrode is made of wire the wire is first insulated with any fibrous material to keep the strands from touching each other and to retain in place the de-polarising reagent. In order to prevent the charging current from affecting the detecting electrodes by passing in at one end of them and out at the other it is desirable to construct these electrodes so that they may be shielded from the charging current. This may be effected in various ways as for instance by forming each electrode as a disc disposed at one end of a tube formed of insulating material. The other end of the tube is open. To guard against the introduction of misleading differences of potential due to differences of salinity in the electrolyte in which the electrode is immersed the electrode may be surrounded or covered by a layer of jelly or like substance of a suitable nature as for example agar-agar. This jelly may be placed over the disc electrode within the insulating tube.

The charging electrodes E and F may be constructed in various ways the material employed however being such as will not be attacked by sea water. For example each of these electrodes may comprise a cylindrical rod of insulating material having two or more flutings of substantial depth cut throughout its length and spaced apart. Each fluting is lined with a plate of suitable metal and these plates are all connected to the cable by which the electrode is towed. The inner electrode E may be hollow and the cable from the outer electrode F carried through it.

If a submarine is in the return path of the charging current a part of this current will flow through the vessel and the effect of the current entering one end of the submarine and leaving the other is to cause a counter electromotive force to be set up between the places where the current enters and where it leaves the submarine. The latter thus becomes in effect a secondary battery of which the two poles are connected by the body of the submarine itself.

In practice it is found that the wires connecting the detecting electrodes A and B to the galvanometer D or other indicating instrument are liable to give misleading indications by cutting irregularly the earth's magnetic field. To obviate this where the electrodes are towed the cables by which they are towed are twinned from the electrode A which is nearest to the towing ship C to a point inboard of this vessel. If as may sometimes be desirable the electrodes are attached to the hull of the vessel each electrode is mounted on a suitable insulating base and the wires therefrom led to the indicating instrument. As these wires are caused to cut the earth's magnetic field as the vessel rolls a compensating coil is introduced into the circuit. This compensating coil is so disposed that the electromotive force induced in it by the rolling of the vessel is equal and opposite in phase to that induced in the leads from the electrodes.

When the electrodes are towed the broadside-on motion through the sea of the wire joining the electrodes may be reduced by making this wire of the density of water or it may be buoyed to that density for example by flat-sided floats. Alternatively the wire may be guided by planes fixed at intervals and preferably each having a dihedral angle.

If it is desired to obtain some directional indication of the position of the submerged conducting body the arrangement illustrated in Figure 3 may be employed. In this case two pairs of detecting electrodes AB and A^1B^1 are used the electrodes forming each pair being spaced apart and both pairs towed with kites H or similar devices by means of which the pairs of electrodes can be spread apart in the manner shown. Each pair of electrodes is connected to a separate galvanometer D and D^1 which will then give port and starboard indications. Alternatively both pairs of electrodes may be connected to a differential galvanometer D^2 as shown in dotted lines in Figure 3.

By employing an arrangement such as shown in Figure 3 in conjunction with a differential galvanometer or other like differential instrument it is possible to

eliminate disturbances due to parallel currents of electricity in the sea which causes deflections in the instrument when the course is changed or to similar movements of the cables through the earth's magnetic field while at the same time retaining the necessary sensitiveness to disturbances or currents of local origin. The arrangement illustrated in Figure 3 is intended to be used either with or without a charging current.

A differential circuit may be used if desired when the electrodes are mounted on the hull of the vessel in place of being towed. If desirable the electrodes may be mounted on the ends of a rigid member of suitable construction adapted to be towed through the water.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:—

1. In the detection of conducting bodies submerged in an electrolyte the employment of two or more electrodes spaced apart in the electrolyte the electrodes being disposed in circuit with a galvanometer or other suitable indicator of continuous or direct current.

2. In the detection of conducting bodies submerged in an electrolyte the combination with two or more electrodes spaced apart in the electrolyte of one or more galvanometers or like indicating instruments arranged in circuit with these electrodes whereby a secondary continuous or direct current which flows or is caused to flow from the submerged conducting body can be detected.

3. In the detection of conducting bodies submerged in an electrolyte the employment of a charging current which is caused to flow through the electrolyte from two electrodes whereby a secondary current is set up from the conducting body which secondary current is detected by means of two or more electrodes spaced apart in the electrolyte the detecting electrodes being disposed in circuit with a galvanometer or other suitable indicator of continuous or direct current.

4. In the detection of conducting bodies submerged in an electrolyte the combination with two electrodes through which a charging current is caused to flow through the electrolyte of two or more detecting electrodes spaced apart in the electrolyte and one or more galvanometers or like indicating instruments arranged in circuit with the detecting electrodes whereby a secondary continuous or direct current which is caused by the charging current to flow from the submerged conducting body can be detected.

5. In the detection of conducting bodies submerged in an electrolyte the combination with four electrodes arranged in pairs the electrodes forming each pair being disposed in tandem and the two pairs spaced apart laterally with relation to the ship's course of a differential galvanometer in circuit with both pairs of electrodes whereby a secondary continuous or direct current which flows or is caused to flow from the submerged conducting body can be detected.

6. The hereindescribed method of detecting a conducting body submerged in an electrolyte either with or without the employment of a charging current.

7. The apparatus for detecting a conducting body submerged in an electrolyte as described and illustrated in Figure 1 or in Figure 2 or in Figure 3 of the accompanying drawings.

Dated this 16th day of September, 1918.

H. G. LAW,
Agent for the Applicant.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1922.

[This Drawing is a reproduction of the Original on a reduced scale]

FIG. 1.

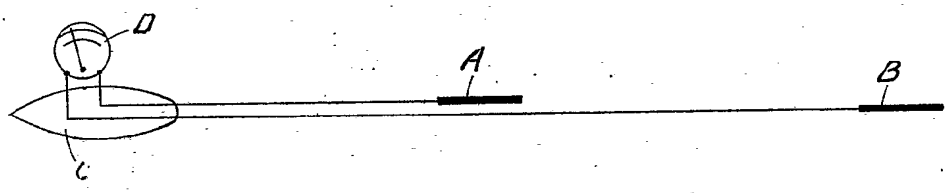


FIG. 2.

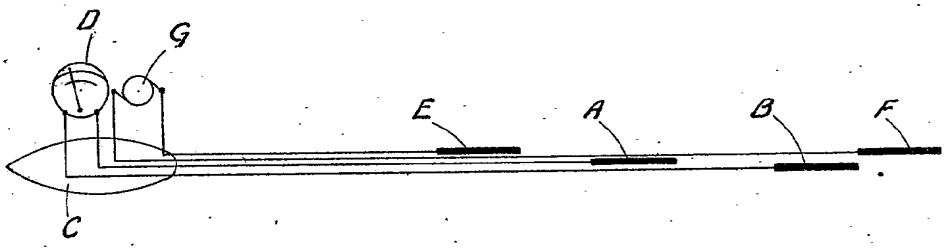
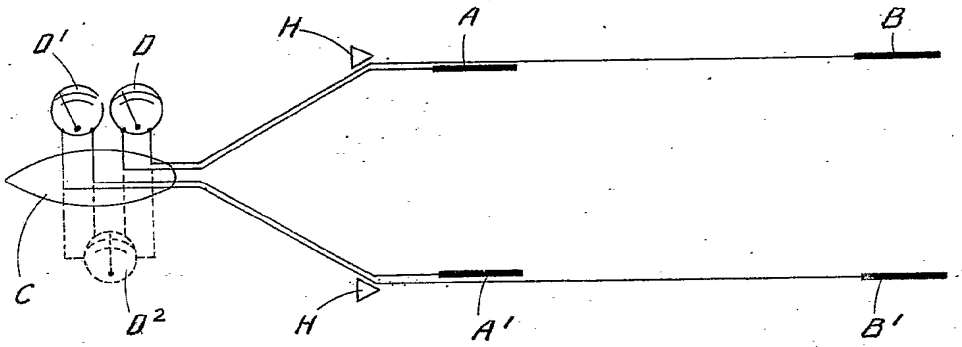


FIG. 3.



Malby&Sons, Photo-Litho